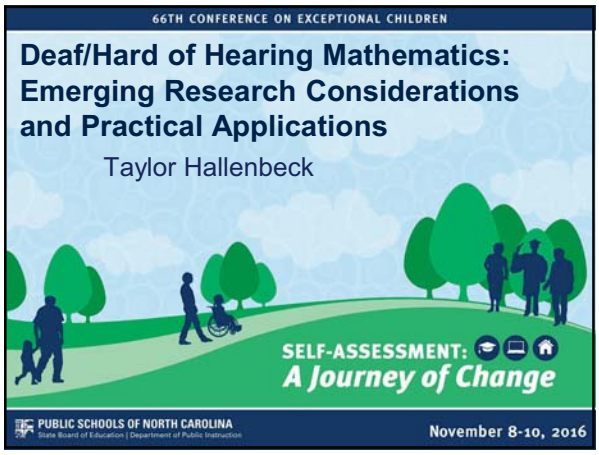

Disclaimer

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Clarification

- Results suggest possible critical implications for the field.
- None are part of current Evidence-Based-Practices or Research-Based-Practices.

Vocabulary

- Deaf/Hard of Hearing
  - *Deaf (*culture): See a *language* difference, a linguistic and cultural minority.
  - *Hard of hearing*: Some see a hearing *deficit*. Some see an *access* deficit, and minority.

Vocabulary

- Languages
  - Spoken English
  - American Sign Language

Introduction

Retrieved from http://www.ellenfinkelstein.com/pptblog/a-good-introductionopener/

Parameters

Mathematics development *may not be* the same as hearing children

- Age range 2.5 to 9 years
- Some use American Sign Language
- Some use Spoken English

Big Idea

Mathematics development *may not be* the same as hearing children

- Young age (Range 2.5 to 9 years)
- Some use American Sign Language
- Some use Spoken English

"The most debilitating aspect of deafness is not the hearing loss, but the lack of language that results from insufficient…input" (Easterbrooks & Baker, 2002, pg. 33)

Why It's Important

Retrieved from http://www.philsimon.com/blog/management/essential-personnel-only/

Gap Starts Early

- DHH children **3 – 5 years old**
- One study found, "that **half of the children tested below average**…in their **understanding of foundational concepts** in number and problem solving"
  (Pagliaro & Kritzer, 2013, pg. 149)

Small ravine…

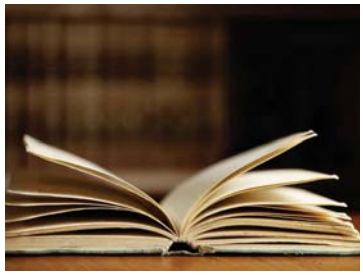
Retrieved from http://www.geograph.org.uk/photo/927767

Gap Doesn't Close

- Stanford Achievement Test
- 1974 – 2003
- Median performance 18 years (high school graduation):
  - Application: Grade 6
  - Math procedure: Grade 8 (computation)
    (Qi & Mitchell, 2012)

…Huge canyon

Retrieved from http://solarcosmos.tistory.com/696



The Content

Retrieved from https://fishofgold.net/2013/02/05/books-books-books/

Remember!

Ideas presented here are *general*, not *rules*!
Things to think about, not live by.

Spatial Frameworks

Retrieved from http://www.freeimageslive.co.uk/taxonomy/term/68?page=1

Literature Background

Children who are oral DHH (speech/listening) reproduce numbers in a spatial framework more accurately than hearing peers, ages 2.5 to 4.5. (Zarfaty, Nunes, & Bryant, 2004)

Unpacking the Literature

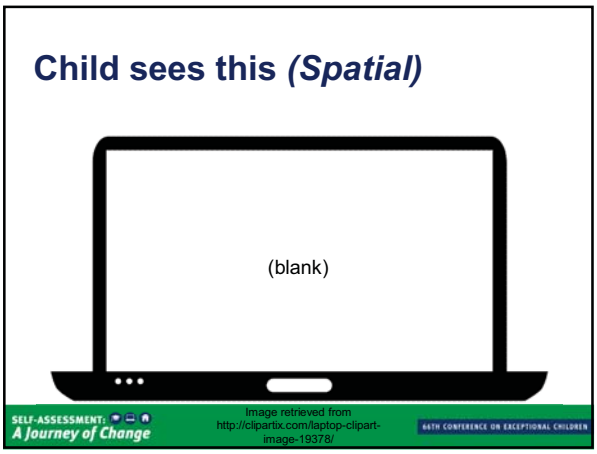
Image retrieved from http://www.clipartvision.com/unpacking-backpack-clipart/

Age	Language	Skill
2.5 – 4.5 years	Speaking and Listening	Reproduce number in Spatial Framework

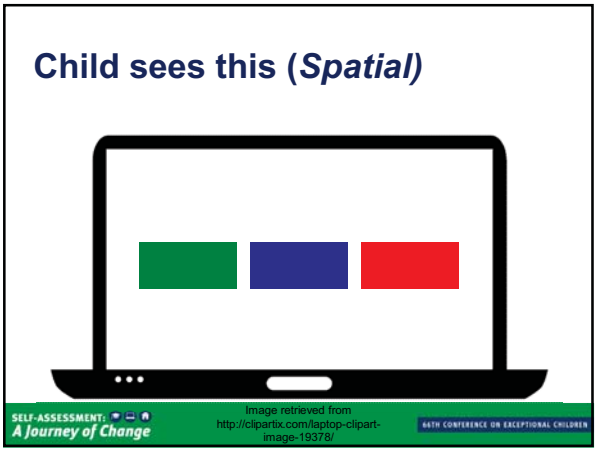
Context

- Set of bricks (2, 3, or 4) shown on screen.
- Screen went blank.
- Child reproduced the set using real-life bricks.
- *Spatial:* Bricks shown as one set, and disappeared as one set.
- *Temporal:* Bricks appeared/disappeared one at a time

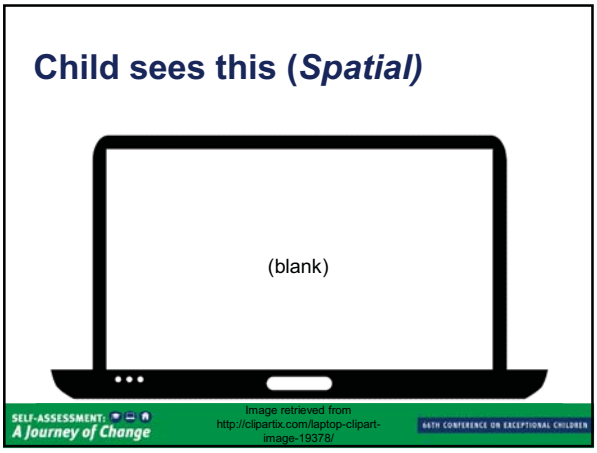
Child sees this *(Spatial)*



Child sees this (*Spatial)*



Child sees this (*Spatial)*



Recall + Reproduce

- Child reproduces sequence with real bricks

Image retrieved from http://ngmnexpo.com/cube-clip-art-7551/

Child sees this (*Temporal)*

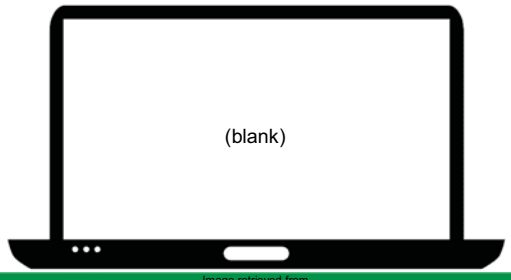
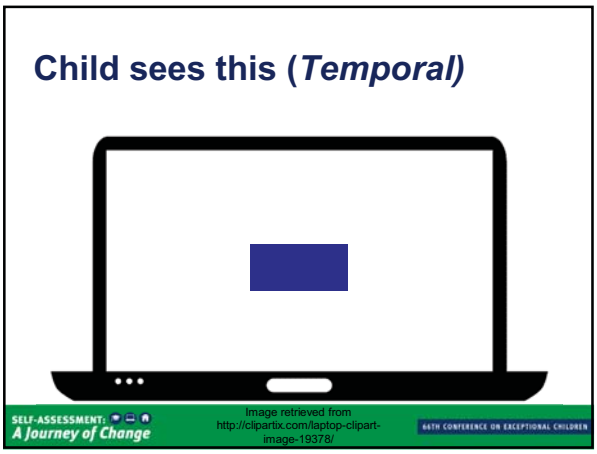


Image retrieved from http://clipartix.com/laptop-clipart-image-19378/

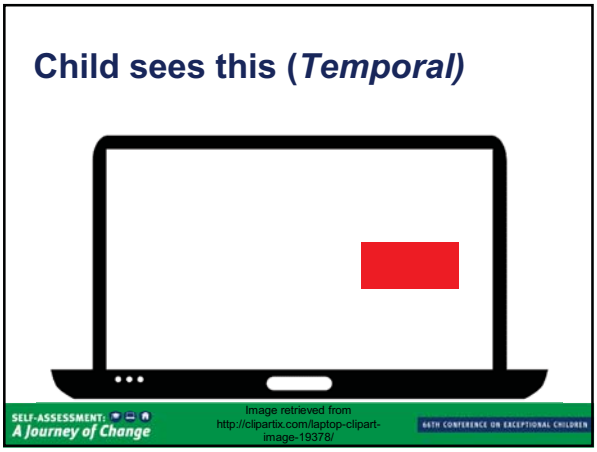
Child sees this (*Temporal)*

Image retrieved from http://clipartix.com/laptop-clipart-image-19378/

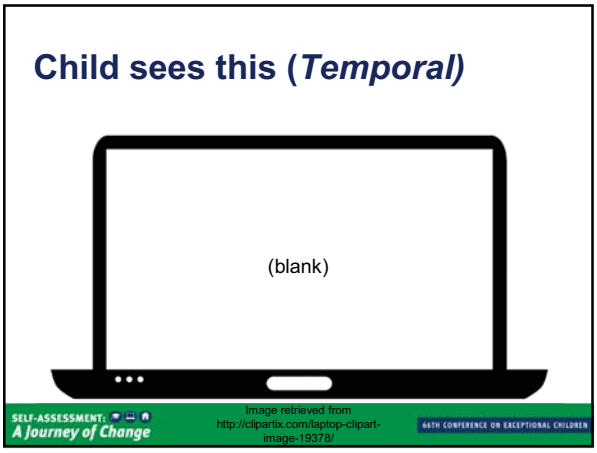
Child sees this (*Temporal)*



Child sees this (*Temporal)*



Child sees this (*Temporal)*



Recall + Reproduce

- Child reproduces sequence with real bricks

SELF-ASSESSMENT: A Journey of Change

Image retrieved from http://ngmnexpo.com/cube-clip-art-7551/

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

Study Results

- Deaf **remembered number of items spatially** more accurately, in more trials, than hearing
- Deaf **reproduced number of items spatially** more accurately, in more trials, than hearing
- **No differences on temporal** remembering/reproducing between Deaf or hearing

SELF-ASSESSMENT: A Journey of Change

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

What does this mean?

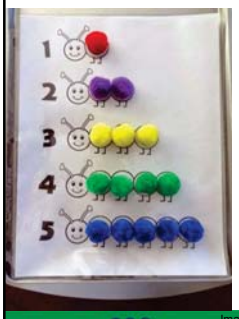
- "The deaf preschool children…were at no disadvantage in representing and discriminating number"

  (Zarfaty, Nunes, & Bryant, 2004, pg. 323)
- DHH Thoughts
  - Spatial then temporal
  - Provide spatial even if difficult for hearing. Gap Gain opportunity!

SELF-ASSESSMENT: A Journey of Change

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

I Do It



- Spatial → pom poms stuck together before
- Temporal → give pom poms one at a time

Image & Activity retrieved from http://momstotschool.blogspot.ca/2014/05/butterflies.html

We Do It

- Spatial →
- Temporal →

Image & Activity retrieved from http://funhandprintartblog.com/2015/03/fingerprint-counting-printables-for-spring.html

We Do It

- Spatial →Dip fingers in a group
- Temporal → Dab fingers one at a time

Image & Activity retrieved from http://funhandprintartblog.com/2015/03/fingerprint-counting-printables-for-spring.html

You Do It

- Spatial →
- Temporal →

Image & Activity retrieved from http://mominspiredlife.com/apple-tree-counting-activity-with-clothespins/

You Do It

- Spatial → Provide all apples at once, then choose clothes peg
- Temporal → Place apples on tree one at a time, then choose clothes peg

Image & Activity retrieved from http://mominspiredlife.com/apple-tree-counting-activity-with-clothespins/

Word Problem Structure

Retrieved from http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-051-structural-engineering-design-fall-2003/

Unpacking the Literature

Image retrieved from http://www.clipartvision.com/unpacking-backpack-clipart/

SELF-ASSESSMENT: A Journey of Change

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

Age

5 – 9 years old

Language

ASL

Skill

Problem structure to support solving skill development

(Ansell & Pagliaro, 2006)

SELF-ASSESSMENT: A Journey of Change

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

Problem Action

Picture (static problem)

Movie (action problem)

https://openclipart.org/detail/17373/photos
http://www.hcpl.net/category/tags/childrens-movie-day

SELF-ASSESSMENT: A Journey of Change

66TH CONFERENCE ON EXCEPTIONAL CHILDREN

Static or Action?

- 5 children were on the trampoline. 3 children got off. How many children are on the trampoline now?

Capture in a movie or a picture?

https://www.flickr.com/photos/purpleslog/1106852126/

Static or Action?

Capture in a movie or a picture?

- Cooper has 6 bones. Toby has 3 bones. How many bones do the dogs have?

Literature Background

Easier Word Problem *Structure*

- Hearing
  - - Explicit action present?
- Deaf
  - - No action (static)
  - - Operation is canonical: 'matches' number presentation in story

(Ansell & Pagliaro, 2006)

Number Presentation

- Leslie had 12 buttons. 5 were yellow. How many were orange?
- 5 brown horses and 3 black horses are in a field. How many horses are there?

Action or static?
Operation canonical?

Action or static?
Operation canonical?

Number Presentation

- Leslie had 12 buttons. 5 were yellow. How many were orange?
- 5 brown horses and 3 black horses are in a field. How many horses are there?

Static
Operation canonical? **No**

Static?
Operation canonical? **Yes**

Problem 1

- In Mr. Gray's class there are 10 boys and 8 girls. How many students are in Mr. Gray's class?

Evaluation

Static? | Action? | Canonical operation?

https://openclipart.org/detail/96277/checkbox-unchecked-disabled

Problem 1

- In Mr. Gray's class there are 10 boys and 8 girls. How many students are in Mr. Gray's class?

Evaluation		
Static?	Action?	Canonical operation?
Yes	No	Yes

Problem 2

- On Monday Sally bought 8 books. On Thursday she bought 4 books. How many books did Sally buy this week?

Evaluation		
Static?	Action?	Canonical operation?

Problem 2

- On Monday Sally bought 8 books. On Thursday she bought 4 books. How many books did Sally buy this week?

Evaluation		
Static?	Action?	Canonical operation?
No	Yes	Yes

Problem 3

- Samar had some baseballs. Kim came over and brought 4 baseballs. Now they have 12 balls. How many balls did Samar start with?

Evaluation		
Static?	Action?	Canonical operation?

https://openclipart.org/detail/96277/checkbox-unchecked-disabled

Problem 3

- Samar had some baseballs. Kim came over and brought 4 baseballs. Now they have 12 balls. How many balls did Samar start with?

Evaluation		
Static?	Action?	Canonical operation?
No	Yes	No

https://openclipart.org/detail/96277/checkbox-unchecked-disabled

Skill Progression

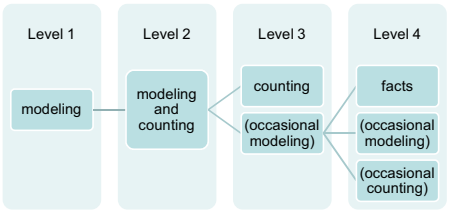
Retrieved from http://thecollaboratory.wikidot.com/2015-sociology

Unpacking the Literature

Image retrieved from http://www.clipartvision.com/unpacking-backpack-clipart/

Age	Language	Skill
5 – 9 years	ASL	Solving Strategies • H: one process • D: another process

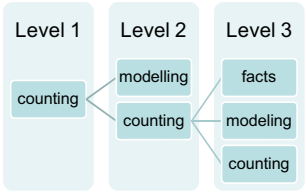
Hearing Strategies



"Studies of young hearing children show…a general progression…from modeling to counting to fact based." (Carpenter, 1985)

(Pagliaro & Ansell, 2012, pg. 452)

Deaf Strategies



"Counting strategies were used predominately, fact-based strategies were used sparingly, and modeling strategies were used moderately." (Pagliaro & Ansell, 2012, pg. 452)

Big Idea

Difference!

Image retrieved from http://www.canstockphoto.com/illustration/difference.html

Things to Think About

- Assessments
  - Is child demonstrating skills as represented in research based in *his/her* language?
- Materials
  - Does child need individual support for modelling/facts?
- Expectations
  - Is child showing growth within their progression?
- IEP goals
  - Consider if the child is demonstrating a difference, not delay. May change the content of the goal.

Conclusion

http://www.paranormalyte.com/the-psychic-diet-part-1/

http://elldiversity.wikispaces.com/Wordle+Gallery

http://www.mitaliblog.com/2016/03/mind-gap-questions-about-power-for.html

Questions?

tlhallen@uncg.edu

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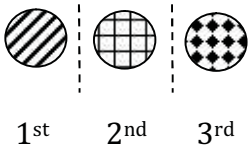
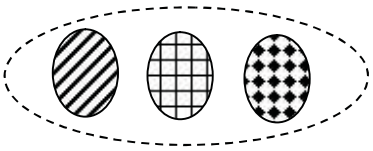
Deaf/Hard of Hearing Mathematics:
Emerging Research Considerations and Practical Applications

Taylor Hallenbeck

SPATIAL FRAMEWORKS *to identify numbers*

Deaf children who use spoken English (2.5 – 4.5 years) recognize spatially represented numbers, earlier, and with more accuracy than hearing peers. (Zarfaty, Nunes, & Bryant, 2004)

Temporal *Number pieces one at a time*	**Spatial** *Number pieces in one group*
 1st 2nd 3rd	

Example

Spatial Activity: _____

_____

_____

_____

Temporal Activity: _____

_____

_____

_____

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WORD PROBLEM STRUCTURE

Deaf children who use ASL and hearing children (all 5 – 9 years) find different types of word problems to be difficult. (Ansell & Pagliaro, 2006)

Is the change in the problem action (movie) or static (picture)?
Does the order of numbers in the problem 'match' the operations needed to solve the problem?

Example

• In Mr. Gray's class there are 10 boys and 8 girls. • How many students are in Mr. Gray's class?	• Samar had some baseballs. • Kim came over and brought 4 baseballs. • Now they have 12 balls. • How many balls did Samar start with?
Easier for… ○ Deaf ○ Hearing	Easier for… ○ Deaf ○ Hearing
Why?	Why?

SKILL PROGRESSION

The Deaf children in this study, who use ASL, showed the possibility of progressing *differently* than their hearing peers. (Pagliaro & Ansell, 2012, pg. 452)

Deaf children progress in their story problem solving skills as: counting first (and most of the time), modelling next (some of the time) and facts last (not often).

Hearing children progress in their story problem solving skills as: modelling first, counting next, facts last.

BIG IDEAS

1. **Your student's <u>language matters</u>! Be sure to consider if research was conducted in ASL, English, or both.**
2. **The <u>gap starts early</u>!**
3. **The child may be progressing <u>differently</u>, not behind!**